Adaptive holographic pumping of liquid crystal lasers

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A major disadvantage of organic lasers, such as liquid crystal (LC) lasers [1, 2], is the occurrence of unwanted photo-bleaching effects which can degrade and even curtail lasing output. This means that such lasers must be operated in pulsed modes at relatively low repetition rates (< kHz) [3]. This work presents an alternative pumping technique for thin-film LC lasers, which allows higher repetition rates to be accessed and photo-bleaching effects to be minimised [4].

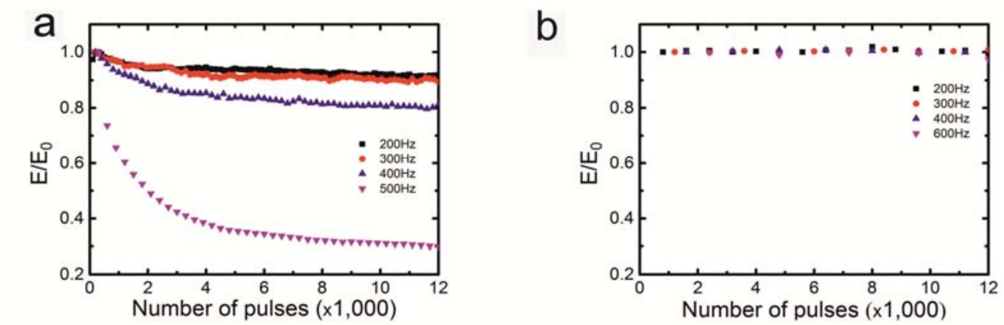

Fig 1 - Output stability of static pumping (**a**) compared to adaptive pumping (**b**).

By controlling the position of incidence of the pump beam onto LC lasers using a reconfigurable computer-generated hologram, different locations on the LC can be pumped without the need for moving parts or flushing mechanisms. It is shown that by using this technique, an increase in both the stability of the laser output with time and its average output power may be achieved.

Furthermore, by reflecting the pump laser beam from a spatial light modulator displaying a hologram that diffracts the light into a spot in a particular position – or pattern of positions – at the LC, lasing can occur from a precisely designed location or pattern of locations. This may then simply be changed by altering the hologram displayed. If the position of incidence is moved to fresh regions quickly enough, degradation effects may be minimised.

This technique also allows additional functionality such as spatial shaping of the pump beam and wavelength tuning of an LC laser, both of which are demonstrated in this presentation. Such a pumping scheme offers the potential to create novel pump-beam profiles to optimise propagation through the LC and improve the laser performance.

References:

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